

## PATENT ABSTRACTS OF JAPAN

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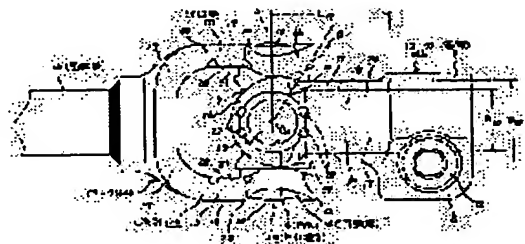
## (54) YOKE FOR UNIVERSAL JOINT

## (57)Abstract:

PROBLEM TO BE SOLVED: To provide the large joint angle by making a virtual intersection exist in a part to respective arched parts from a flat part when a second virtual flat surface intersecting with a first virtual flat surface at the first center axis part with the specified intersection is considered and the virtual intersection at which the second virtual flat surface and peripheral edges of respective circular holes are intersected with one another is considered.

SOLUTION: A surface including a second virtual flat surface (including a chain line and existing in the direction perpendicular to the paper surface) intersecting a first virtual flat surface at the first center axis part at the intersection angle of 35° is considered.

Next, a virtual intersection P at which the second virtual flat surface and the peripheral edges of respective circular holes 4 are intersected with one another in the part to the base part from the first center axis is considered. The sizes of respective parts 16, 23, 18, 4 are so regulated that the virtual intersection P may exist in a part the arched parts 16, 16 from respective flat parts 18, 18, namely, that the virtual intersection P may exist in the arched parts 16, 16 or inclined step parts 23, 23. Since chamfer parts 21, 21 are provided on both ends in the width direction of respective flat parts 18, 18, arms 3a, 3a can be prevented from interfering with each other.



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**CLAIMS**

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**[Claim(s)]**

[Claim 1] The base for being built by performing plastic working to a metal plate, and carrying out joint immobilization of the edge of a revolving shaft, One pair of arms which extended from the diameter direction opposite side location to the shaft orientations of the above-mentioned base on the shaft-orientations end edge of this base, In York for universal joints which was formed in the point of these both-arms section and which was mutually equipped with the circular hole of this alignment in the tip approach part of each above-mentioned arm the near part of each above-mentioned circular hole It is the radii section of the shape of cross-section radii which made the field which counters mutually the cylinder-like concave surface. The first virtual flat surface which intersects perpendicularly with the second medial axis which is the core of the above-mentioned revolving shaft including the first medial axis which the pars intermedia of each above-mentioned arm is an parallel flat part mutually, and is the virtual straight line which connects the cores of each above-mentioned circular hole is considered. The second virtual flat surface which crosses with the crossover include angle of 35 degrees in the medial-axis parts of this first virtual flat surface and the above first is considered. York for universal joints characterized by this virtual intersection existing in each above-mentioned radii section approach part rather than each above-mentioned flat part when the virtual intersection when the virtual flat surface of the above second and the periphery of each above-mentioned circular hole cross in the above-mentioned base approach part rather than the first medial axis of the above is considered.

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DETAILED DESCRIPTION

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## [Detailed Description of the Invention]

[0001]

[Field of the Invention] York for universal joints concerning this invention connects the edges of one pair of revolving shafts which do not exist on the same straight line, and is related with York which constitutes the universal joint which enables transfer of turning effort among both [ these ] revolving shafts.

[0002]

[Description of the Prior Art] For example, the power steering system for automobiles is constituted by connecting two or more revolving shafts of each other, such as a steering shaft and an intermediate shaft, with a serial through 1 thru/or two or more universal joints. In such a case, the universal joint which connects one pair of York by the spider, enabling free displacement, and consists of the former as a universal joint to be used and which is called a Cardan joint is used widely. Moreover, building by performing plastic working to the metal plate which has sufficient rigidity, such as a steel plate, for York which constitutes such a universal joint is also widely performed from the former as indicated by JP,47-50053,B, JP,3-75772,B, JP,4-27221,U, JP,59-8014,Y, etc.

[0003] Drawing 12 shows the 1st example of such conventional structure of York for universal joints. This York 1 of the 1st example consists of a base 2 and one pair of arms 3 and 3 which extended from the shaft-orientations end edge of this base 2. In order that the base 2 of these may insert the edge of the revolving shaft which should fix above-mentioned York 1, it forms in the segmental circle tubed which made one circumferencial direction discontinuity, and has formed one pair of flanges 5 and 6 which counter mutually in discontinuity. And in order to make the rod part of the above-mentioned bolt screw the through-hole 7 for inserting the rod part of a bolt (not shown) in one flange 6 in the flange 5 of another side, the above-mentioned through-hole 7 and the screw-thread hole 8 of this alignment are formed, respectively.

[0004] On the other hand, each above-mentioned arms 3 and 3 have extended from the diameter direction opposite side location to the shaft orientations of the above-mentioned base 2 on the shaft-orientations end edge of the above-mentioned base 2. Each [ these ] arms 3 and 3 make the field which counters mutually the cylinder-like concave surface. Moreover, the circular holes 4 and 4 of this alignment are mutually formed in the point of each [ these ] arms 3 and 3. In constituting a universal joint combining above-mentioned York 1 and a spider 9, it presses the bearing cups 10 and 10 fit in each above-mentioned circular hole 4 and 4. Each [ these ] bearing cups 10 and 10 function as an outer ring of spiral wound gasket of a radial needle bearing, and enable joint support of the rocking displacement of a spider 9 to above-mentioned York 1.

[0005] Moreover, drawing 13 -14 show the 2-3rd example of the conventional structure of York for universal joints built by performing plastic working too to the metal plate. Among these, York of 2nd example 1a shown in drawing 13 forms base 2a in a cross-section U typeface. York 1a and a revolving shaft are made to carry out relative rotation of the revolving shaft which combines the edge with such York 1a by making the cross-section configuration of an edge into an ellipse at least at the time of association. In addition, in the case of the structure of the 2nd example shown in this drawing 13, the screw-thread hole for screwing a bolt in the through-hole 11 formed in the flange 5 by carrying out press fit immobilization of the nut 12 is constituted. Moreover, York of 3rd example 1b shown in drawing 14 forms base 2b in the shape of a cylinder. In order to combine such York 1b and the edge of a revolving shaft, press fit fitting of the edge of this revolving shaft is carried out by the tight fit at the above-mentioned base 2b through the direct or elastic cylinder 27 (refer to drawing 10 which shows the gestalt of operation of this invention). The circular holes 4 and 4 for carrying out fitting immobilization of the bearing cup 10 ( drawing 12 ) are formed like York 1 of the 1st example shown also in above-mentioned drawing 12 or the point of arms 3 and 3 which constitutes York of such 2-3rd example.

[0006]

[Problem(s) to be Solved by the Invention] In the case of the structure which made the field where one pair of arms 3 and 3 counter mutually the cylinder-like concave surface, the section modulus of each [ these ] arms 3 and 3 is large, and while sufficient reinforcement is securable, the arm 3 of one pair of York each other combined through a spider 9 and three comrades become easy to interfere, as it indicates to drawing 12 -14 or is indicated by JP,47-50053,B. Consequently, the joint angle of a universal joint which is the crossover include angle of these one pairs of medial axes of York cannot be enlarged. In order to prevent that a steering column is thrust up at an operator side in recent years in case of a collision, the joint angle of the universal joint included in the power steering system for automobiles is enlarged, and the design this universal-joint part makes it easy to bend in case of a collision is increasing. In order to enable such a design, it is necessary to enlarge the joint angle of a universal joint, and

amelioration is desired.

[0007] On the other hand, when one pair of arms are made flat as indicated by JP,3-75772,B, one pair of arms of York mutually combined through a spider make it hard to interfere, and the joint angle of a universal joint can be enlarged. However, in the case of York for universal joints (refer to the 1-3rd Fig. of an official report) indicated by this official report, since [ of one pair of arms ] the whole is almost flat, the section modulus of each [ these ] arm is small. Therefore, in order to secure sufficient reinforcement, the thickness dimension of the metal plate which constitutes York for universal joints will have to be enlarged, and a manufacturing cost will increase in a weight list.

[0008] Furthermore, in the case of the structure made to deform the part in which the circular hole for fitting in a bearing cup by one pair of arms [ a part of ] was formed in the direction which approaches each other, reservation and cost reduction of a joint angle are difficult as indicated by JP,4-27221,U and JP,59-8014,Y. Namely, in the case of the structure indicated by each [ these ] official report, if compared with the structure which indicates to said drawings 1212 -14, or is indicated by JP,47-50053,B, a big joint angle is realizable, but the case where it is still inadequate can be considered depending on a car. Moreover, in order to make one pair of arms [ a part of ] which constitute York made from a metal plate which has big rigidity, such as a heavy-gage steel plate, deform, that large-sized press equipment is needed etc. becomes the cause by which an installation cost increases and cost increases too. Securing sufficient reinforcement in view of such a situation, it can acquire a big joint angle and this invention invents it that cheap York for universal joints should moreover be realized.

[0009]

[Means for Solving the Problem] York for universal joints of this invention is built by performing plastic working to a metal plate like conventional York for universal joints mentioned above, and equips with the circular hole of this alignment each other who was formed in the base for carrying out joint immobilization of the edge of a revolving shaft, one pair of arms which extended from the diameter direction opposite side location to the shaft orientations of the above-mentioned base on the shaft-orientations end edge of this base, and the point of these both-arms section. Especially in York for universal joints of this invention, the near part of each above-mentioned circular hole is the radii section of the shape of cross-section radii which made the field which counters mutually the cylinder-like concave surface in the tip approach part of each above-mentioned arm, and the pars intermedia of each above-mentioned arm is an parallel flat part mutually. Furthermore, the first virtual flat surface which intersects perpendicularly with the second medial axis which is the core of the above-mentioned revolving shaft including the first medial axis which is the virtual straight line which connects the cores of each above-mentioned circular hole is considered. The second virtual flat surface which crosses with the crossover include angle of 35 degrees in the medial-axis parts of this first virtual flat surface and the above first is considered. When the virtual intersection when the virtual flat surface of the above second and the periphery of each above-mentioned circular hole cross in the above-mentioned base approach part rather than the first medial axis of the above is considered, this virtual intersection exists in each above-mentioned radii section approach part rather than each above-mentioned flat part.

[0010]

[Function] According to this invention which has the above configurations, securing sufficient reinforcement, a big joint angle can be acquired and, moreover, cheap York for universal joints can be obtained. First, it is the part supported for a spider, enabling free rocking, and the radii section which twists from this spider and receives the load of a direction at the time of transfer of turning effort and which constitutes the tip approach part of one pair of arms cannot deform easily, and can also fully secure the substantial fitting die length with the bearing cup for supporting the above-mentioned spider. Therefore, at the time of transfer of turning effort, a bearing cup is dedrop hard, carries out from the circular hole formed in the point of each arm, and the substantial reinforcement of York for universal joints can be secured.

[0011] Moreover, since the pars intermedia of each arm which is the part which approaches each other most is used as the flat part when turning effort is transmitted among both [ these ] York after one pair of medial axes of York which constitute a universal joint have crossed, one pair of arms of York stop being able to interfere easily mutually. Therefore, a universal joint with a big joint angle can be obtained. And it is the configuration which can perform bending of each part comparatively easily, and since it can build even if it does not use large-sized press equipment especially, a manufacturing cost does not increase.

[0012]

[Embodiment of the Invention] Drawing 1 -6 show the 1st example of the gestalt of operation of this invention. This invention is carried out to one pair of all of York 14a and 14b that constitute a universal joint 13. Among these, York 14a [ on the other hand / (left of drawing 1 -2) ] is fixed to the edge of the revolving shafts 15, such as a steering shaft, by welding. On the other hand, York 14b of another side makes attachment and detachment free to the edge of another revolving shaft which is not illustrated. That is, York 14b of this another side consists of a base 2 and one pair of arms 3a and 3a which extended from the shaft-orientations end edge of this base 2. In order that the base 2 of these may insert the edge of another revolving shaft which should fix York 14b of above-mentioned another side conventionally like the case of structure shown in the above-mentioned drawings 1212 -13, it is formed in the segmental circle tubed which made one circumferential direction discontinuity, and makes \*\*\*\* of a bore free. And one pair of flanges 5 and 6 which counter mutually are formed in discontinuity. Moreover, while forming the through-hole 7 for inserting the rod part of a bolt (not shown) in one flange 5, the screw-thread hole for screwing the above-mentioned bolt in the through-hole 11 formed in the flange 6 of another side by carrying out press fit immobilization of the nut 12 is prepared. In addition, the inner skin of the above-mentioned base 2 and the edge

outside peripheral surface of the revolving shaft according to above are enabling serration engagement mutually.

[0013] On the other hand, each above-mentioned arms 3a and 3a have extended from the diameter direction opposite side location to the shaft orientations of the above-mentioned base 2 on the shaft-orientations end edge of the above-mentioned base 2. In addition, the configuration of each [ these ] arms 3a and 3a which is the focus of this invention is with above-mentioned one York 14a and York 14b of another side, and is fundamentally the same. Then, the following explanation is explained focusing on York 14b of above-mentioned another side. The circular holes 4 and 4 of this alignment are mutually formed in the point of each above-mentioned arms 3a and 3a. At the time of the assembly of said universal joint 13, to each [ these ] circular holes 4 and 4, inner fitting immobilization of the bearing cups 10 and 10 is carried out, and the edge of a spider 9 is supported free [ rocking displacement ]. After carrying out inner fitting of the bearing cups 10 and 10 into each [ these ] circular hole 4 and 4, plastic deformation of the outer edge opening periphery section of each [ these ] circular holes 4 and 4 is carried out to the method of the inside of the diameter direction, the caulking sections 22 and 22 are formed, and each above-mentioned bearing cups 10 and 10 prevent escaping from and appearing from each above-mentioned circular holes 4 and 4 in the method of outside. The above configuration is the same as that of York for universal joints known from the former.

[0014] Especially, in York 14b for universal joints of this invention (14a), it is considering as the radii sections 16 and 16 of the shape of cross-section radii which made the field which counters mutually the near part of each above-mentioned circular holes 4 and 4 the cylinder-like concave surface in the tip approach part of each above-mentioned arms 3a and 3a. In the example of illustration, the radii sections 16 and 16 prepared in the point of one pair of arms 3a and 3a which counter mutually are mostly arranged in single cylinder space.

[0015] Moreover, the amount of [ with the pars intermedia 16 and 16 of each above-mentioned arms 3a and 3a, i.e., each above-mentioned radii sections, and the continuation sections 17 and 17 which follow the shaft-orientations point (left end section of drawing 1 -3) of said base 2 ] Mabe is considering as the parallel flat parts 18 and 18 mutually. It is located on the lateral surface 19 and 19 of each [ these ] flat parts 18 and 18, i.e., the same flat surface as the part which the field of the opposite side is the circumferential direction center section of the lateral surface of both the above-mentioned radii sections 16 and 16 mutually a passage clear from drawing 1 , and 2, 3, 4 and 6, and was left most. On the other hand, a passage too clear from drawing 3 , and 4 and 6, the medial surfaces 20 and 20 of each above-mentioned flat parts 18 and 18, i.e., the field which counters mutually, are the circumferential direction center sections of the medial surface of both the above-mentioned radii sections 16 and 16, and it is located on the same flat surface as the part each other left most. In addition, the end face section of each above-mentioned radii sections 16 and 16 and the point of each above-mentioned flat parts 18 and 18 are made to continue mutually by the inclination steps 23 and 23. Moreover, chamfers 21 and 21 are formed in the crosswise both-ends edge of the above-mentioned medial surfaces 20 and 20, and the width method W20 of both [ these ] the medial surfaces 20 and 20 is made smaller ( $W20 < W18$ ) than each above-mentioned flat part 18 and the width method W18 of the 18 whole. In addition, even if the activity which forms each [ these ] chamfers 21 and 21 is based on plastic working, such as press working of sheet metal and forging, it is good also by cutting.

[0016] Furthermore, in York 14b (14a) of this invention, the dimension covering the shaft orientations of York 14b of the above-mentioned radii sections 16 and 16, the inclination steps 23 and 23, and flat parts 18 and 18 (longitudinal direction of drawing 1 -3) is regulated as follows by relation with the magnitude of each of said circular holes 4 and 4. That is, the first virtual flat surface (field which exists in the space of drawing 1 in the direction of a right angle including the chain line alpha of drawing 1 ) which intersects perpendicularly with said base 2 at the second medial axis which is the core of said another revolving shaft which carries out joint immobilization of the point is considered including the first medial axis which is the virtual straight line (straight line which passes the point O4 of drawing 1 and intersects perpendicularly with the space of drawing 1 ) which connects the cores of each above-mentioned circular holes 4 and 4. Next, the second virtual flat surface (field which exists in the space of drawing 1 in the direction of a right angle including the chain line beta of drawing 1 ) which crosses with the crossover include angle of 35 degrees in the medial-axis parts of this first virtual flat surface and the above first is considered. Next, the virtual intersection P when the virtual flat surface of the above second and the periphery of each above-mentioned circular hole 4 cross rather than the first medial axis of the above in the above-mentioned base 2 approach part (rightist-inclinations part of drawing 1 ) is considered. And the magnitude of each part 16, 23, 18, and 4 of the above is regulated so that this virtual intersection P may exist in each above-mentioned radii section 16 and 16 approach parts rather than each above-mentioned flat parts 18 and 18, namely, so that the above-mentioned virtual intersection P may exist in the above-mentioned radii sections 16 and 16 or the inclination steps 23 and 23.

[0017] It can prevent the bearing cups 10 and 10 falling out from each circular holes 4 and 4 which are constituted by York 14b (14a) of this invention which has the above configurations and which were formed in the point of each arms 3a and 3a which constitute York 14a and 14b in the case of a universal joint 13, and coming out of it. That is, since the section modulus of the point of each above-mentioned arms 3a and 3a in which each [ these ] circular holes 4 and 4 were formed is large, it is hard to deform the part in which each [ these ] circular holes 4 and 4 were formed. Moreover, even when the thickness dimension of the metal plate which constitutes York 14a and 14b based on the cross section of the radii sections 16 and 16 which are the parts in which each [ these ] circular holes 4 and 4 were formed curving is the same, the fitting die length of each above-mentioned circular holes 4 and 4 and the bearing cups 10 and 10 can be enlarged. Consequently, the difficulty of escaping from each above-mentioned circular holes 4 and 4 of sufficient reinforcement 10 and 10, i.e., each above-mentioned bearing cups, is securable.

[0018] Moreover, in the case of the above-mentioned universal joint 13, a big joint angle can be acquired. That is,

after one pair of medial axes of York 14a and 14b which constitute this universal joint 13 have crossed, when turning effort is transmitted between both [ these ] York 14a and 14b, the crosswise both-ends ulnar margin of the pars intermedia of each above-mentioned arms 3a and 3a approaches each other most. In the case of York 14a and 14b of this invention, since the pars intermedia of each above-mentioned arm which is the part which approaches this appearance for each other most is used as flat parts 18 and 18, the one above-mentioned pair of arm 3a of York 14a and 14b and 3a stop being able to interfere easily mutually. It can be made especially harder in this example, to interfere in above-mentioned arm 3a and 3a, since chamfers 21 and 21 are formed in the crosswise both-ends edge of each above-mentioned flat parts 18 and 18 which is the crosswise both-ends ulnar margin of the pars intermedia of each above-mentioned arms 3a and 3a where \*\*\*\*\* also approaches each other. Therefore, a universal joint with a big joint angle can be obtained.

[0019] In addition, what is necessary is to make small the width method W18 ( drawing 1 ) of the continuation sections 17 and 17 which make each [ these ] flat parts 18 and 18 and a base 2 follow the width method list of each above-mentioned flat parts 18 and 18 which approaches each other most, and just to enlarge both [ these ] the flat parts 18 and the spacing dimension D18 ( drawing 2 ) of 18 comrades, in order to enlarge a joint angle. However, each [ these ] dimensions W18 and D18 receive regulation from the field which prevents enlargement of a universal joint 13 in order to secure the reinforcement to need. Therefore, the describing [ above ] width method W18 is large, and although the above-mentioned spacing dimension D18 is small, the configuration which can acquire a big joint angle is desirable. York for universal joints of this invention realizes such a configuration. In addition, since they can make small width method W18' from the field of interference prevention and said chamfers 21 and 21 can make small spacing dimension D18' ( drawing 6 ), securing the describing [ above ] width method W18, they are desirable from the field which reconciles maintenance on the strength and reservation of a joint angle.

[0020] Moreover, York 14a and 14b of this invention is the configurations which can perform bending of each part comparatively easily. That is, it is not necessary to bend a part of arm with big curvature like the structure indicated by above-mentioned JP,4-27221,U and JP,59-8014,Y. Therefore, since it can build even if it does not use large-sized press equipment especially, a manufacturing cost does not increase.

[0021] Next, drawing 7 -8 show the 2nd example of the gestalt of operation of this invention. In this example, it forms heavy-gage by turning up the edge section of the metal plate which constitutes above-mentioned York 24 for one pair of flanges 5a and 6a prepared in base 2' of York 24, respectively 180 degrees. And in order to make the rod part of the above-mentioned bolt screw the through-hole 7 for inserting the rod part of a bolt (not shown) in one flange 5a in flange 6a of another side, the above-mentioned through-hole 7 and the screw-thread hole 8 of this alignment are formed, respectively. Other configurations and operations are the same as that of the case of the 1st example mentioned above.

[0022] Next, drawing 9 shows the 3rd example of the gestalt of operation of this invention. In this example, chamfers 21 and 21 like [ in the 1st example ] mentioned above are not formed in the crosswise both-ends edge of each flat parts 18 and 18 which is the crosswise both-ends ulnar margin of the pars intermedia of one pair of arms 3a and 3a. Therefore, in this example, if compared with the case of the 1st above-mentioned example, above-mentioned arm 3a and 3a will be easy to interfere, but if conventionally compared with structure, it twists with reservation of a joint angle and can be compatible by high order origin in strong reservation. Other configurations and operations are the same as that of the case of the 1st example mentioned above.

[0023] Next, drawing 10 shows the 4th example of the gestalt of operation of this invention. In this example, York 25 of another side (left of drawing 10) is supported free [ some displacement ] at the edge of a revolving shaft 15 through a pin 26 and the elastic cylinder 27. For this reason, the circular hole 28 for making the both ends of the above-mentioned pin 26 \*\*\*\* is formed in the two diameter direction opposite side location of base 2b' of above-mentioned York 25. In addition, the difference of the inside diameter of a circular hole 28 and the outer-diameter dimension of a pin 24 is a thing for absorbing vibration added to a steering system. In the case of such structure of this example, it prevents that vibration is transmitted between above-mentioned York 25 and a revolving shaft 15, and can prevent in it that vibration generated in the wheel side gives propagation to a steering wheel, and gives an operator displeasure. Other configurations and operations are the same as that of the case of the 1st example mentioned above.

[0024]

[Example] Next, drawing 11 shows the result of the experiment which this invention person conducted in order to check the effectiveness of this invention. Conventionally, the experiment made conditions other than a configuration the same, built two or more four kinds of samples (York) of elegance, this invention article, and prototype \*\* and prototype \*\* every, respectively, and was conducted by each thing [ twisting and comparing reinforcement with the magnitude of a joint angle ]. In addition, it twists, and reinforcement is twisted to the universal joint incorporating the sample concerned, adds the load of a direction, and means the magnitude of the load to which this universal joint results in breakage. Moreover, a joint angle means the maximum of the joint angle to which the variation rate of both [ these ] York can be carried out, without one pair of York which constitute the universal joint concerned interfering mutually. In addition, about all samples, the material of construction considered as the hot rolling mild steel plate, board thickness set to 6.0mm, and spacing D19 (refer to drawing 4 ) of the lateral surface of one pair of arms was set to 41mm.

[0025] Moreover, elegance is the thing of a configuration which it was indicated [ thing ] by above-mentioned JP,47-50053,B, or continues and incurvated one pair of arms 3 and 3 as shown in drawing 12 for each overall length conventionally [ above-mentioned ]. The joint angle of elegance was about 45 degrees conventionally [ this ].

Moreover, the above-mentioned this invention article is the thing of a configuration as shown in drawing 1 -6 mentioned above. The joint angle of this this invention article was about 60 degrees. in addition, in order to make a joint angle into 60 degrees on condition that a \*\*\*\* in the case of this invention article Width method W18' by for example, the case where 21mm and spacing dimension D18' are set to 31mm It is made 0.6 or more times (W18 (W18')  $\geq 0.6L17$ ) of the distance L17 from the first virtual flat surface which expressed the width method W18 (W18') of said flat parts 18 and 18 with the chain line alpha to drawing 1 to the end face section of said continuation section 17. The sample belonging to this invention article satisfies this condition, and a joint angle becomes 60 degrees. Moreover, each overall length is covered and one pair of arms which were indicated to be the above-mentioned prototype \*\*s by above-mentioned JP,3-75772,B are made flat. The joint angle of this prototype \*\* was about 55 degrees. Furthermore, prototype \*\* is the configuration indicated by JP,47-50053,B, and the width method of the pars intermedia of one pair of arms is made small so that a joint angle may be made to 60 degrees. [0026] the universal joint constituted by York for universal joints of this invention secures a big joint angle, and, moreover, is big so that clearly from the publication of drawing 11 whose each the universal joint constituted by each sample built in the above configurations twists, and expresses reinforcement — it twists and reinforcement can be obtained. In addition, the straight line gamma indicated to an axis of abscissa and parallel at drawing 11 is required of the universal joint included in the power steering system for automobiles of a common passenger car, is twisted, and expresses reinforcement (need reinforcement). In addition, one pair of arms only turned at prototype \*\* for a while outside, it became the inclination for a bearing cup to slip out from the circular hole formed in the point of each arm, and reservation of need reinforcement was difficult for it. Moreover, the deformation of prototype \*\* of one pair of arms increased, it became the inclination for a bearing cup to slip out from each circular hole too, and reservation of need reinforcement was difficult for it.

[0027]

[Effect of the Invention] Since it can acquire a big joint angle and can moreover obtain cheap York for universal joints, York for universal joints of this invention being constituted as it was stated above, it acting, and securing sufficient reinforcement, it can aim at operator protection effectively, for example, and, moreover, can attain easy-ization of a design of the cheap power steering system for automobiles.

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DESCRIPTION OF DRAWINGS

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## [Brief Description of the Drawings]

[Drawing 1] The side elevation of a universal joint showing the 1st example of the gestalt of operation of this invention.

[Drawing 2] Drawing which cut the part and was seen from the lower part of drawing 1 .

[Drawing 3] Drawing which took out only York on the right-hand side of drawing 1 -2, and was seen drawing 2 and from said.

[Drawing 4] Drawing seen from the left of drawing 3 .

[Drawing 5] The A-A sectional view of drawing 3 .

[Drawing 6] This B-B sectional view.

[Drawing 7] The same drawing as drawing 3 showing the 2nd example of the gestalt of operation of this invention.

[Drawing 8] The C-C sectional view of drawing 7 .

[Drawing 9] The same drawing as drawing 3 showing the 3rd example of the gestalt of operation of this invention.

[Drawing 10] The side elevation of a universal joint showing this 4th example.

[Drawing 11] The graph which shows the result of the experiment conducted in order to check the effectiveness of this invention.

[Drawing 12] It is the side elevation where the 1st example of York known from the former was shown, (a) looked at the top view and (b) looked at the E-E sectional view of (a), and (c) from the lower part of (a).

[Drawing 13] It is the side elevation where this 2nd example is shown and (a) similarly looked at a top view, drawing which looked at (b) from the method of the right of (a), and (c) from the lower part.

[Drawing 14] It is the side elevation where this 3rd example is shown and (a) looked at end view, the side elevation which looked at (b) from the method of the right of (a), and (c) from the upper part of (b).

## [Description of Notations]

- 1, 1a, 1b York
- 2, 2a, 2b, 2', 2b' Base
- 3 3a Arm
- 4 Circular Hole
- 5, 5a, 6, 6a Flange
- 7 Through-hole
- 8 Screw-Thread Hole
- 9 Spider
- 10 Bearing Cup
- 11 Through-hole
- 12 Nut
- 13 Universal Joint
- 14a, 14b York
- 15 Revolving Shaft
- 16 Radii Section
- 17 Continuation Section
- 18 Flat Part
- 19 Lateral Surface
- 20 Medial Surface
- 21 Chamfer
- 22 Caulking Section
- 23 Inclination Step
- 24 25 York
- 26 Pin
- 27 Elastic Cylinder
- 28 Circular Hole

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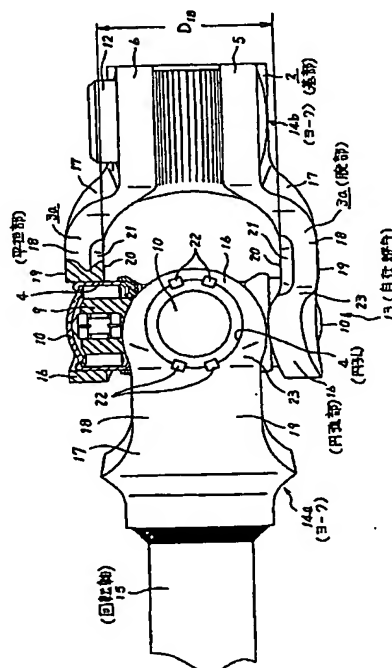
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(54) 【発明の名称】 自在継手用ヨーク

(57)【要約】

【課題】 強度を確保しつつ大きなジョイント角を得られる構造を、大型化せず安価に実現する。

【解決手段】 ヨーク14bを構成する1対の腕部3a、3aは、軸受カップ10を嵌合する為の円孔4を形成した先端部を円弧部16、16とし、中間部を平坦部18、18とする。この構成により、円孔4からの軸受カップ10の抜け出しを防止し、且つ、1対のヨーク14a、14bの腕部3a、3a同士が干渉しにくくできる。



## 【特許請求の範囲】

【請求項1】 金属板に塑性加工を施す事により造られ、回転軸の端部を結合固定する為の基部と、この基部の軸方向一端縁で直径方向反対側位置から上記基部の軸方向に延出した1対の腕部と、これら両腕部の先端部に形成された、互いに同心の円孔とを備えた自在継手用ヨークに於いて、上記各腕部の先端寄り部分で上記各円孔の近傍部分は、互に対向する面を円筒状の凹面とした断面円弧状の円弧部であり、上記各腕部の中間部は互いに平行な平坦部であり、上記各円孔の中心同士を結ぶ仮想直線である第一の中心軸を含み上記回転軸の中心である第二の中心軸に直交する第一の仮想平面を考え、この第一の仮想平面と上記第一の中心軸部分で35度の交差角度を持って交差する第二の仮想平面を考え、上記第一の中心軸よりも上記基部寄り部分で上記第二の仮想平面と上記各円孔の周縁とが交差する仮想交点を考えた場合に、この仮想交点が上記各平坦部よりも上記各円弧部寄り部分に存在する事を特徴とする自在継手用ヨーク。

## 【発明の詳細な説明】

【0001】

【発明の属する技術分野】この発明に係る自在継手用ヨークは、同一直線上に存在しない1対の回転軸の端部同士を連結して、これら両回転軸同士の間で回転力の伝達を可能とする自在継手を構成するヨークに関する。

【0002】

【従来の技術】例えば自動車用操舵装置は、ステアリングシャフト及び中間軸等の複数本の回転軸を、1乃至複数個の自在継手を介して互いに直列に連結する事により構成している。この様な場合に使用する自在継手として従来から、十字軸により1対のヨーク同士を変位自在に連結して成る、カルダン継手と呼ばれる自在継手が、広く使用されている。又、この様な自在継手を構成するヨークを、鋼板等、十分な剛性を有する金属板に塑性加工を施す事により造る事も、例えば特公昭47-50053号公報、特公平3-75772号公報、実開平4-27221号公報、実公昭59-8014号公報等に記載されている様に、従来から広く行なわれている。

【0003】図12は、この様な自在継手用ヨークの従来構造の第1例を示している。この第1例のヨーク1は、基部2と、この基部2の軸方向一端縁から延出した1対の腕部3、3とから成る。このうちの基部2は、上記ヨーク1を固定すべき回転軸の端部を挿入する為、円周方向1箇所を不連続とした欠円筒状に形成しており、不連続部には、互に対向する1対のフランジ5、6を設けている。そして、一方のフランジ6に、ボルト（図示せず）の杆部を挿通する為の通孔7を、他方のフランジ5に、上記ボルトの杆部を螺合させる為、上記通孔7と同心のねじ孔8を、それぞれ形成している。

【0004】一方、上記各腕部3、3は、上記基部2の軸方向一端縁で直径方向反対側位置から、上記基部2の

軸方向に延出している。これら各腕部3、3は、互に対向する面を円筒状の凹面としている。又、これら各腕部3、3の先端部には、互いに同心の円孔4、4を形成している。上記ヨーク1と十字軸9とを組み合わせる自在継手を構成する場合には、上記各円孔4、4内に軸受カップ10、10を圧入する。これら各軸受カップ10、10は、ラジアルニードル軸受の外輪として機能し、上記ヨーク1に対して十字軸9を、揺動変位自在に結合支持する。

10 【0005】又、図13~14は、やはり金属板に塑性加工を施す事により造った自在継手用ヨークの従来構造の第2~3例を示している。このうち、図13に示した第2例のヨーク1aは、基部2aを断面U字形に形成している。この様なヨーク1aにその端部を結合する回転軸は、少なくとも端部の断面形状を小判形として、結合時にヨーク1aと回転軸とが相対回転しない様になっている。尚、この図13に示した第2例の構造の場合には、フランジ5に形成した通孔11にナット12を圧入固定する事により、ボルトを螺合する為のねじ孔を構成している。又、図14に示した第3例のヨーク1bは、基部2bを円筒状に形成している。この様なヨーク1bと回転軸の端部とを結合するには、この回転軸の端部を上記基部2bに、直接、又は弾性筒27（本発明の実施の形態を示す図10参照）を介して、締まりばめで圧入嵌合する。この様な第2~3例のヨークを構成する腕部3、3の先端部にも、上述の図12に示した第1例のヨーク1と同様に、軸受カップ10（図12）を嵌合固定する為の円孔4、4を形成している。

【0006】

30 【発明が解決しようとする課題】図12~14に記載し、或は特公平47-50053号公報に記載されている様に、1対の腕部3、3の互に対向する面を円筒状の凹面とした構造の場合には、これら各腕部3、3の断面係数が大きく、十分な強度を確保できる反面、十字軸9を介して互いに結合される1対のヨークの腕部3、3同士が干渉し易くなる。この結果、これら1対のヨークの中心軸同士の交差角度である、自在継手のジョイント角を大きくできない。近年、衝突事故の際にステアリングコラムが運転者の側に突き上げられる事を防止する為、自動車用操舵装置に組み込む自在継手のジョイント角を大きくして、衝突事故の際にこの自在継手部分が折れ曲がり易くする設計が増えている。この様な設計を可能にする為には、自在継手のジョイント角を少しでも大きくする必要があり、改良が望まれている。

40 【0007】これに対して、特公平3-75772号公報に記載されている様に、1対の腕部を平坦にした場合には、十字軸を介して互いに結合される1対のヨークの腕部同士が干渉しにくくして、自在継手のジョイント角を大きくできる。但し、この公報に記載された自在継手用ヨーク（公報の第1~3図参照）の場合には、1対の

腕部のほぼ全体が平坦である為、これら各腕部の断面係数が小さい。従って、十分な強度を確保する為には、自在継手用ヨークを構成する金属板の厚さ寸法を大きくしなくてはならず、重量並びに製作費が高んでしまう。

【0008】更に、実開平4-27221号公報、実公昭59-8014号公報に記載されている様に、1対の腕部の一部で軸受カップを嵌合する為の円孔を形成した部分を、互いに近づき合う方向に変形させた構造の場合には、ジョイント角の確保とコスト低減とが難しい。即ち、これら各公報に記載された構造の場合には、前記図12~14に記載し、或は特公平47-50053号公報に記載されている構造に比べれば大きなジョイント角を実現できるが、車両によっては依然として不十分な場合が考えられる。又、厚肉鋼板等、大きな剛性を有する金属板製のヨークを構成する1対の腕部の一部を変形させる為には大型のプレス装置が必要になる等、設備費が高み、やはりコストが高む原因となる。本発明は、この様な事情に鑑みて、十分な強度を確保しつつ、大きなジョイント角を得られ、しかも安価な自在継手用ヨークを実現すべく発明したものである。

【0009】

【課題を解決するための手段】本発明の自在継手用ヨークは、前述した従来の自在継手用ヨークと同様に、金属板に塑性加工を施す事により造られ、回転軸の端部を結合固定する為の基部と、この基部の軸方向一端縁で直径方向反対側位置から上記基部の軸方向に延出した1対の腕部と、これら両腕部の先端部に形成された、互いに同心の円孔とを備える。特に、本発明の自在継手用ヨークに於いては、上記各腕部の先端寄り部分で上記各円孔の近傍部分は、互いに対向する面を円筒状の凹面とした断面円弧状の円弧部であり、上記各腕部の中間部は互いに平行な平坦部である。更に、上記各円孔の中心同士を結ぶ仮想直線である第一の中心軸を含み上記回転軸の中心である第二の中心軸に直交する第一の仮想平面を考え、この第一の仮想平面と上記第一の中心軸部分で35度の交差角度を持って交差する第二の仮想平面を考え、上記第一の中心軸よりも上記基部寄り部分で上記第二の仮想平面と上記各円孔の周縁とが交差する仮想交点を考えた場合に、この仮想交点が上記各平坦部よりも上記各円弧部寄り部分に存在する。

【0010】

【作用】上述の様な構成を有する本発明によれば、十分な強度を確保しつつ、大きなジョイント角を得られ、しかも安価な自在継手用ヨークを得られる。先ず、十字軸を揺動自在に支持する部分であり、回転力の伝達時にこの十字軸から振り方向の荷重を受ける、1対の腕部の先端寄り部分を構成する円弧部は、変形しにくく、上記十字軸を支持する為の軸受カップとの実質的嵌合長さも十分に確保できる。従って、回転力の伝達時に各腕部の先端部に形成した円孔から軸受カップが脱落しにくくし

て、自在継手用ヨークの実質的強度を確保できる。

【0011】又、自在継手を構成する1対のヨークの中心軸同士が交差した状態で、これら両ヨーク同士の間で回転力の伝達を行なった場合に、最も近づき合う部分である、各腕部の中間部を平坦部としているので、1対のヨークの腕部同士が互いに干渉しにくくなる。従って、ジョイント角の大きな自在継手を得られる。しかも、各部の曲げ加工を比較的容易に行なえる形状であり、特に大型のプレス装置を使用しなくても造れる為、製作費が高む事もない。

【0012】

【発明の実施の形態】図1~6は、本発明の実施の形態の第1例を示している。自在継手13を構成する1対のヨーク14a、14bの何れにも、本発明を実施している。このうち、一方(図1~2の左方)のヨーク14aは、ステアリングシャフト等の回転軸15の端部に、溶接により固定している。これに対して、他方のヨーク14bは、図示しない別の回転軸の端部に対し、着脱自在としている。即ち、この他方のヨーク14bは、基部2と、この基部2の軸方向一端縁から延出した1対の腕部3a、3aとから成る。このうちの基部2は、前述の図12~13に示した従来構造の場合と同様に、上記他方のヨーク14bを固定すべき別の回転軸の端部を挿入する為、円周方向1箇所を不連続とした欠円筒状に形成して、内径を拡収自在としている。そして、不連続部には、互いに対向する1対のフランジ5、6を設けている。又、一方のフランジ5に、ボルトを挿入する為の通孔7を形成すると共に、他方のフランジ6に形成した通孔11にナット12を圧入固定する事により、上記ボルトを螺合する為のねじ孔を設けている。尚、上記基部2の内周面と上記別の回転軸の端部外周面とは、互いにセレーション係合自在としている。

【0013】一方、上記各腕部3a、3aは、上記基部2の軸方向一端縁で直径方向反対側位置から上記基部2の軸方向に延出している。尚、本発明の特徴点である、これら各腕部3a、3aの形状は、上記一方のヨーク14aと他方のヨーク14bとで、基本的に同じである。そこで、以下の説明は、上記他方のヨーク14bを中心に説明する。上記各腕部3a、3aの先端部には、互いに同心の円孔4、4を形成している。前記自在継手13の組立時にこれら各円孔4、4には、軸受カップ10、10を内嵌固定し、十字軸9の端部を揺動変位自在に支持する。これら各円孔4、4内に軸受カップ10、10を内嵌した後、これら各円孔4、4の外端開口周縁部を直径方向内方に塑性変形させてかしめ部22、22を形成し、上記各軸受カップ10、10が上記各円孔4、4から外方に抜け出る事を防止する。以上の構成は、従来から知られている自在継手用ヨークと同様である。

【0014】特に、本発明の自在継手用ヨーク14b

(14a)の場合には、上記各腕部3a、3aの先端寄

り部分で上記各円孔4、4の近傍部分を、互いに対向する面を円筒状の凹面とした、断面円弧状の円弧部16、16としている。図示の例では、互いに対向する1対の腕部3a、3aの先端部に設けた円弧部16、16を、ほぼ単一円筒空間内に配置している。

【0015】又、上記各腕部3a、3aの中間部、即ち、上記各円弧部16、16と、前記基部2の軸方向先端部（図1～3の左端部）に連続する連続部17、17との間部分は、互いに平行な平坦部18、18としている。これら各平坦部18、18の外側面19、19、即ち互いに反対側の面は、図1、2、3、4、6から明らかな通り、上記両円弧部16、16の外側面の円周方向中央部で、互いに最も離れた部分と同一平面上に位置する。これに対して、上記各平坦部18、18の内側面20、20、即ち互いに対向する面は、やはり図3、4、6から明らかな通り、上記両円弧部16、16の内側面の円周方向中央部で、互いに最も離れた部分と同一平面上に位置する。尚、上記各円弧部16、16の基端部と上記各平坦部18、18の先端部とは、傾斜段部23、23により互いに連続させている。又、上記内側面20、20の幅方向両端縁部には面取り部21、21を設けて、これら両内側面20、20の幅寸法 $W_1$ を、上記各平坦部18、18全体の幅寸法 $W_2$ よりも小さく（ $W_1 < W_2$ ）している。尚、これら各面取り部21、21を形成する作業は、プレス加工、鍛造加工等の塑性加工によっても、或は切削加工によっても良い。

【0016】更に、本発明のヨーク14b（14a）の場合には、上記円弧部16、16と傾斜段部23、23と平坦部18、18との、ヨーク14bの軸方向（図1～3の左右方向）に互る寸法を、前記各円孔4、4の大きさとの関係で、次の様に規制している。即ち、上記各円孔4、4の中心同士を結ぶ仮想直線（図1の点O、を通過して、図1の紙面に直交する直線）である第一の中心軸を含み、前記基部2に先端部を結合固定する前記別の回転軸の中心である第二の中心軸に直交する第一の仮想平面（図1の鎖線 $\alpha$ を含み、図1の紙面に直角方向に存在する面）を考える。次に、この第一の仮想平面と上記第一の中心軸部分で35度の交差角度を持って交差する第二の仮想平面（図1の鎖線 $\beta$ を含み、図1の紙面に直角方向に存在する面）を考える。次に、上記第一の中心軸よりも上記基部2寄り部分（図1の右寄り部分）で上記第二の仮想平面と上記各円孔4の周縁とが交差する仮想交点Pを考える。そして、この仮想交点Pが上記各平坦部18、18よりも上記各円弧部16、16寄り部分に存在する様に、即ち、上記仮想交点Pが、上記円弧部16、16又は傾斜段部23、23に存在する様に、上記各部16、23、18、4の大きさを規制している。

【0017】上述の様な形状を有する本発明のヨーク14b（14a）により構成する、自在継手13の場合に

は、ヨーク14a、14bを構成する各腕部3a、3aの先端部に形成した各円孔4、4から軸受カップ10、10が抜け出る事を防止できる。即ち、これら各円孔4、4を形成した上記各腕部3a、3aの先端部の断面係数が大きいので、これら各円孔4、4を形成した部分に変形しにくい。又、これら各円孔4、4を形成した部分である円弧部16、16の断面が湾曲している事に基づき、ヨーク14a、14bを構成する金属板の厚さ寸法が同じ場合でも、上記各円孔4、4と軸受カップ10、10との嵌合長さを大きくできる。この結果、十分な強度、即ち、上記各軸受カップ10、10の上記各円孔4、4からの抜けにくさを確保できる。

【0018】又、上記自在継手13の場合には、大きなジョイント角を得られる。即ち、この自在継手13を構成する1対のヨーク14a、14bの中心軸同士が交差した状態で、これら両ヨーク14a、14b同士の間で回転力の伝達を行なった場合には、上記各腕部3a、3aの中間部の幅方向両端部内側縁同士が最も近づき合う。本発明のヨーク14a、14bの場合には、この様に最も近づき合う部分である、上記各腕部の中間部を平坦部18、18としているので、上記1対のヨーク14a、14bの腕部3a、3a同士が互いに干渉しにくくなる。特に、本例の場合には、上記最も近づき合う上記各腕部3a、3aの中間部の幅方向両端部内側縁である、上記各平坦部18、18の幅方向両端縁部に面取り部21、21を設けている為、上記腕部3a、3a同士をより干渉しにくくできる。従って、ジョイント角の大きな自在継手を得られる。

【0019】尚、ジョイント角を大きくする為には、最も近づき合う上記各平坦部18、18の幅寸法並びにこれら各平坦部18、18と基部2とを連続させる連続部17、17の幅寸法 $W_1$ （図1）を小さくし、これら両平坦部18、18同士の間隔寸法 $D_1$ （図2）を大きくすれば良い。但し、これら各寸法 $W_1$ 、 $D_1$ は、必要とする強度を確保する為、或は自在継手13の大型化を防止する面から規制を受ける。従って、上記幅寸法 $W_1$ が大きく、上記間隔寸法 $D_1$ が小さいにも拘らず、大きなジョイント角を得られる形状が好ましい。本発明の自在継手用ヨークは、この様な形状を実現するものである。尚、前記面取り部21、21は、上記幅寸法 $W_1$ を確保しつつ、干渉防止の面からの幅寸法 $W_1$ を小さくでき、間隔寸法 $D_1$ （図6）を小さくできる為、強度保持とジョイント角の確保とを両立させる面から好ましい。

【0020】又、本発明のヨーク14a、14bは、各部の曲げ加工を比較的容易に行なえる形状である。即ち、前述の実開平4-27221号公報、実公昭59-8014号公報に記載された構造の様に、腕部の一部を大きな曲率で曲げる必要がない。従って、特に大型のプレス装置を使用しなくても造れる為、製作費が嵩む事も

ない。

【0021】次に、図7～8は、本発明の実施の形態の第2例を示している。本例の場合には、ヨーク24の基部2'に設けた1対のフランジ5a、6aを、それぞれ上記ヨーク24を構成する金属板の端縁部を180度折り返す事により厚肉に形成している。そして、一方のフランジ5aに、ボルト（図示せず）の杆部を挿通する為の通孔7を、他方のフランジ6aに、上記ボルトの杆部を螺合させる為、上記通孔7と同心のねじ孔8を、それぞれ形成している。その他の構成及び作用は、上述した第1例の場合と同様である。

【0022】次に、図9は、本発明の実施の形態の第3例を示している。本例の場合には、1対の腕部3a、3aの中間部の幅方向両端部内側縁である、各平坦部18、18の幅方向両端縁部に、上述した第1例の場合の様な面取り部21、21を設けていない。従って、本例の場合には、上述の第1例の場合に比べれば、上記腕部3a、3a同士が干渉し易いが、従来構造に比べれば、ジョイント角の確保と振り強度の確保とを高次元で両立できる。その他の構成及び作用は、上述した第1例の場合と同様である。

【0023】次に、図10は、本発明の実施の形態の第4例を示している。本例の場合には、他方（図10の左方）のヨーク25は、ピン26と弾性筒27とを介して、回転軸15の端部に、若干の変位自在に支持している。この為、上記ヨーク25の基部2b'の直径方向反対側2箇所位置には、上記ピン26の両端部を遊合させる為の円孔28を形成している。尚、円孔28の内径寸法とピン24の外径寸法との差は、ステアリング装置に加えられる振動を吸収する為のものである。この様な本例の構造の場合には、上記ヨーク25と回転軸15との間で振動が伝わるのを防止し、車輪側で発生した振動がステアリングホイールに伝わり、運転者に不快感を与える事を防止できる。その他の構成及び作用は、前述した第1例の場合と同様である。

【0024】

【実施例】次に、図11は、本発明の効果を確認する為、本発明者が行なった実験の結果を示している。実験は、従来品と、本発明品と、試作品①と、試作品②との4種類の試料（ヨーク）を、形状以外の条件を同じにしてそれぞれ複数個ずつ造り、それぞれの振り強度とジョイント角の大きさを比較する事で行なった。尚、振り強度とは、当該試料を組み込んだ自在継手に振り方向の荷重を加え、この自在継手が破損に至る荷重の大きさを言う。又、ジョイント角とは、当該自在継手を構成する1対のヨーク同士が互いに干渉する事なくこれら両ヨーク同士を変位させ得るジョイント角の最大値を言う。尚、総ての試料に就いて、使用材料は熱間圧延軟鋼板とし、板厚は6.0mmとし、1対の腕部の外側面同士の間隔 $D_{11}$ （図4参照）は4.1mmとした。

【0025】又、上記従来品とは、前述の特公昭47-50053号公報に記載された、或は図12に示す様な、1対の腕部3、3を、それぞれの全長に亘って湾曲させた形状のものである。この従来品のジョイント角は凡そ45度であった。又、上記本発明品とは、上述した図1～6に示す様な形状のものである。この本発明品のジョイント角は、凡そ60度であった。尚、本発明品の場合、上述の条件でジョイント角を60度にする為には、例えば幅寸法 $W_{11}$ を2.1mm、間隔寸法 $D_{11}$ を3.1mmとした場合で、前記平坦部18、18の幅寸法 $W_{11}$ （ $W_{11}$ ）を、図1に鎖線 $\alpha$ で表した第一の仮想平面から前記連続部17の基端部までの距離 $L_{11}$ の0.6倍以上（ $W_{11}$ （ $W_{11}$ ） $\geq 0.6L_{11}$ ）にする。本発明品に属する試料は、この条件を満足し、ジョイント角が60度となったものである。又、上記試作品①とは、前述の特公平3-75772号公報に記載された様な、1対の腕部を、それぞれの全長に亘って平坦にしたものである。この試作品①のジョイント角は凡そ55度であった。更に、試作品②とは、特公昭47-50053号公報に記載された形状で、ジョイント角を60度に行ける様に、1対の腕部の中間部の幅寸法を小さくしたものである。

【0026】それぞれが上述の様な形状に造った各試料により構成した自在継手の振り強度を表す、図11の記載から明らかな様に、本発明の自在継手用ヨークにより構成した自在継手は、大きなジョイント角を確保して、しかも大きな振り強度を得られる。尚、図11に横軸と平行に記載した直線 $\gamma$ は、一般的な乗用車の自動車用操舵装置に組み込む自在継手に要求される振り強度（必要強度）を表している。尚、試作品①は、1対の腕部が外側に少し曲がっただけで、各腕部の先端部に形成した円孔から軸受カップが抜け出す傾向になり、必要強度の確保が難しかった。又、試作品②は、1対の腕部の変形量が多くなり、やはり各円孔から軸受カップが抜け出す傾向になり、必要強度の確保が難しかった。

【0027】

【発明の効果】本発明の自在継手用ヨークは、以上に述べた通り構成され作用し、十分な強度を確保しつつ、大きなジョイント角を得られ、しかも安価な自在継手用ヨークを得られるので、例えば運転者保護を有効に図れ、しかも安価な自動車用操舵装置の設計の容易化を図れる。

【図面の簡単な説明】

【図1】本発明の実施の形態の第1例を示す、自在継手の側面図。

【図2】一部を切断して図1の下方から見た図。

【図3】図1～2の右側のヨークのみを取り出して図2と同方向から見た図。

【図4】図3の左方から見た図。

【図5】図3のA-A断面図。

【図6】同B-B断面図。

【図7】本発明の実施の形態の第2例を示す、図3と同様の図。

【図8】図7のC-C断面図。

【図9】本発明の実施の形態の第3例を示す、図3と同様の図。

【図10】同第4例を示す、自在継手の側面図。

【図11】本発明の効果を確認する為に行なった実験の結果を示すグラフ。

【図12】従来から知られているヨークの第1例を示し、(a)は平面図、(b)は(a)のE-E断面図、(c)は(a)の下方から見た側面図。

【図13】同第2例を示しており、(a)は平面図、(b)は(a)の右方から見た図、(c)は同じく下方から見た側面図。

【図14】同第3例を示しており、(a)は端面図、(b)は(a)の右方から見た側面図、(c)は(b)の上方から見た側面図。

【符号の説明】

1、1a、1b ヨーク

2、2a、2b、2'、2b' 基部

3、3a 腕部

4 円孔

\* 5、5a、6、6a フランジ

7 通孔

8 ねじ孔

9 十字軸

10 軸受カップ

11 通孔

12 ナット

13 自在継手

14a、14b ヨーク

15 回転軸

16 円弧部

17 連続部

18 平坦部

19 外側面

20 内側面

21 面取り部

22 かしめ部

23 傾斜段部

24、25 ヨーク

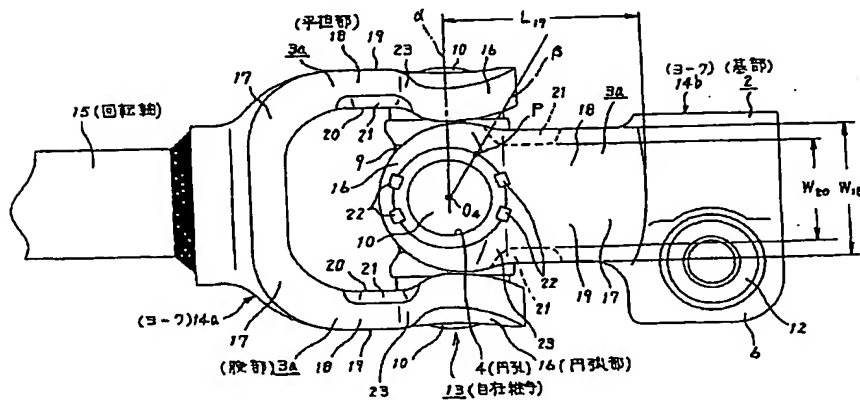
20 26 ピン

27 弾性筒

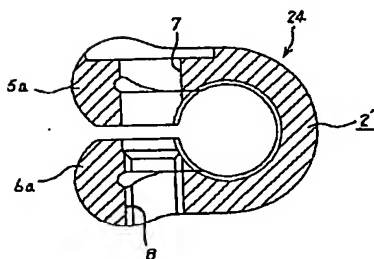
28 円孔

\*

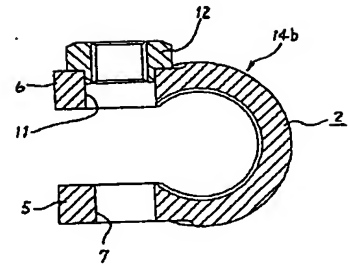
【図1】



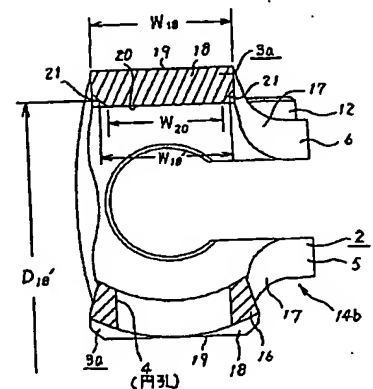
【図8】



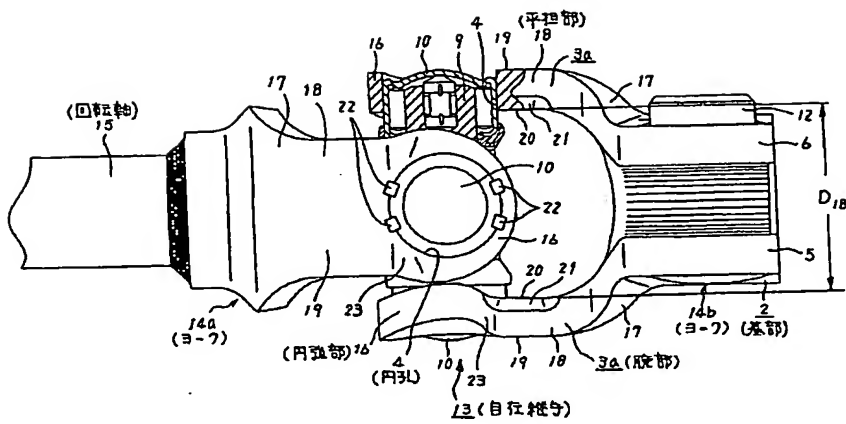
【図5】



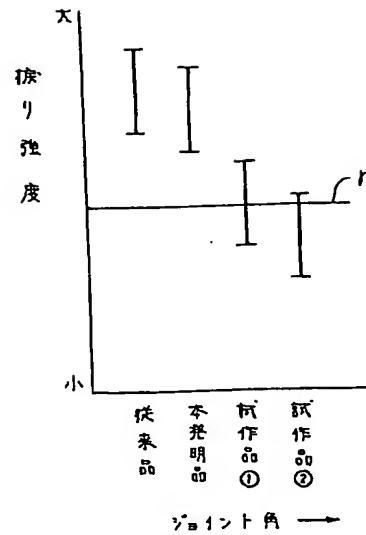
【図6】



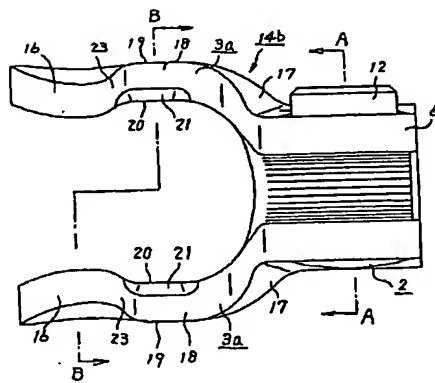
【図2】



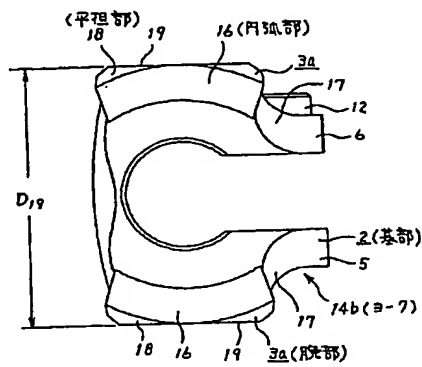
【図11】



【図3】

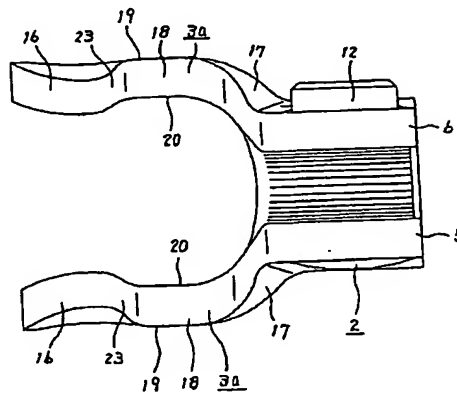
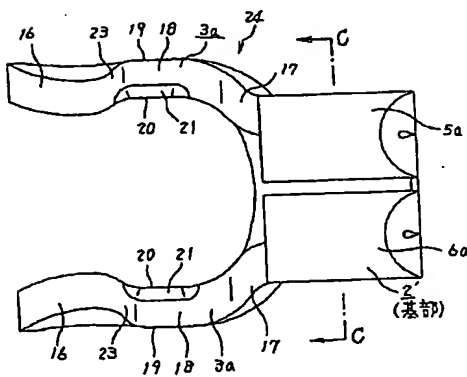


【図4】

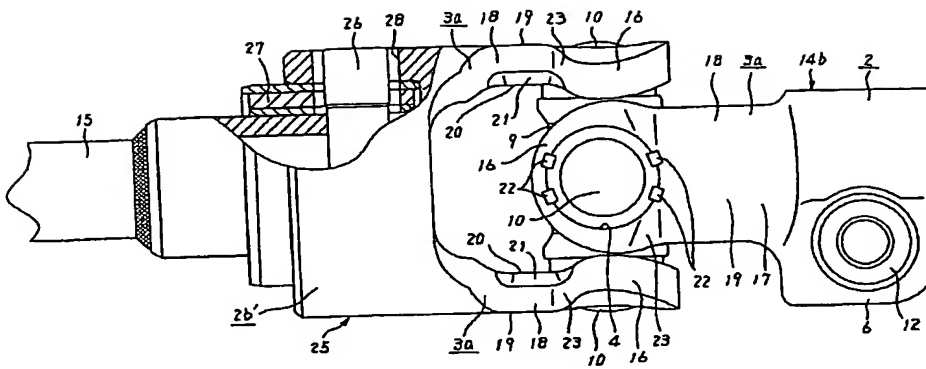


【図9】

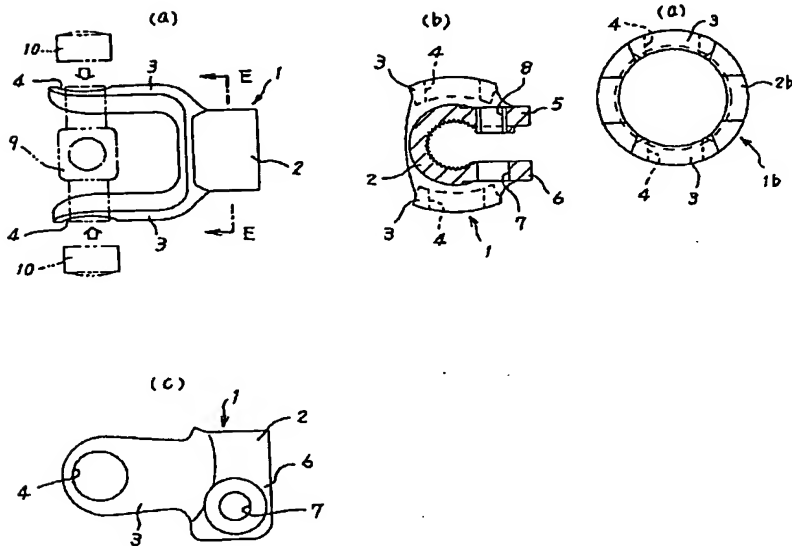
【図7】



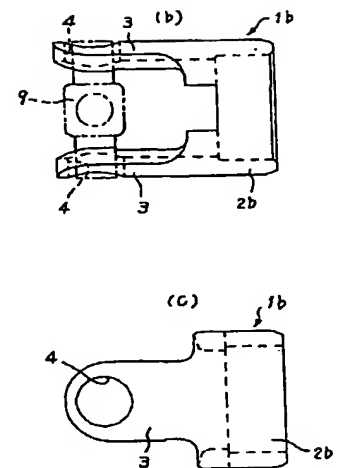
【圖 10】



【圖 12】

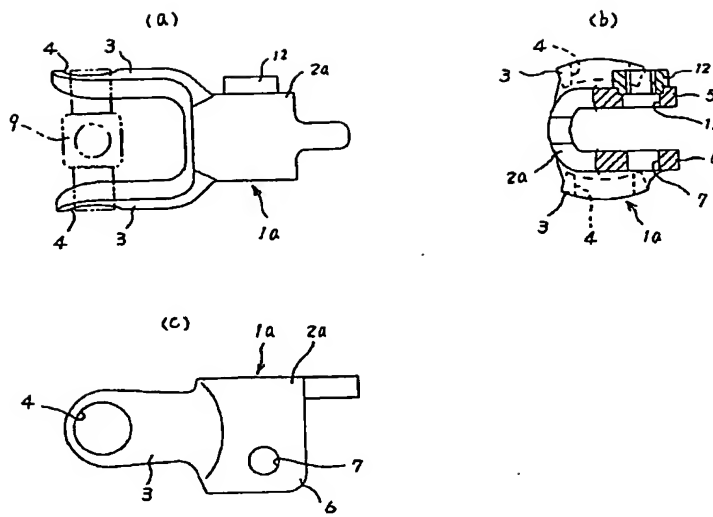


【圖 14】





【図13】



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